भारतीय मानक
Indian Standard

IS 17087 : 2019

वस्त्रादि — मानव निर्मित रेशा धागा — उबलते पानी में संकोचन का निर्धारण

Textiles — Manmade Filament Yarns — Determination of Shrinkage in Boiling Water

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भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली – 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002
www.bis.gov.in www.standardsbis.in

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Physical Methods of Test Sectional Committee, TXD 01

FOREWORD

This Indian Standard was adopted by Bureau of Indian Standards, after the draft finalized by the Physical Method of Test Sectional Committee had been approved by the Textile Division Council.

Manmade thermoplastic filament yarns can be shortened by various influencing factors during processing and use. Usually heating, wetting, or wet-heating process that leads to shrinkage. Depending upon raw material, a filaments reacts more strongly to heat, moisture or moist heat.

The dimensional stability of manmade thermoplastic filament yarns is decided by the residual shrinkage present in the yarn. The residual shrinkage is measured by either boiling water method or hot air method. Shrinkage is an important property because it determines the fabric behavior during end use.

This standard covers the general method of skein preparation, method of test for determining shrinkage in hot water.

Considerable assistance has been derived from ISO 18066 : 2015 ‘Textiles — Manmade filament yarns — Determination of shrinkage in boiling water’ in the formulation of this Indian Standard.

The composition of the Committee responsible for the preparation of this standard is given in Annex A.

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’.

Indian Standard

TEXTILES — MANMADE FILAMENT YARNS — DETERMINATION OF SHRINKAGE IN BOILING WATER

1 SCOPE

1.1 This standard specifies a test method for the determination of the boiling water shrinkage of non-textured and textured multifilament yarns (made of polyester, polyamide, polypropylene, cellulose fibre, etc). Only automatic method is specified in this standard.

1.2 This standard is applicable to manmade filament yarns of linear density less than 3000 dtex and is not applicable to partially oriented yarns.

2 REFERENCES

The standards given below contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below:

IS No.	*Title*
6359 : 1971	Method for conditioning of textiles
1070 : 1992	Reagent grade water — Specification (*third revision*)

3 TERMS AND DEFINITIONS

For the purposes of this standard, the following terms and definitions shall apply.

3.1 Shrinkage in Boiling Water — It is decrease in length of a specimen as a result of thermal treatment in boiling water, expressed as a percentage of its original length, which is measured under tension before and after treatment.

4 PRINCIPLE

Under specific condition, a test specimen is treated in boiling water. Shrinkage is calculated as variation in length, measured before and after treatment.

5 APPARATUS AND MATERIALS

5.1 Skein Winding Reel

a) Reel with a circumference of (1 000 ± 2.5) mm, driven either automatically or manually.

b) A traversing mechanism to avert overlapping while a number of skeins being wound at the same time.

c) A tensioning device, to an accuracy of ± 10 percent, maintaining tension within the recommended limits.

d) A device to count the turns of the reel, preferably warning or stopping winding automatically, just prior to the specified number of reel revolutions.

e) A mechanism to reduce the reel circumference is advisable for easy removal of the skein.

5.2 Automatic Shrinkage Tester (*See* Fig. 1)

a) Automatically application of the specified tension, appliance to measure the length of the specimen and to calculate the shrinkage based on the length values.

b) Resolution of the length measurement is 0.05 mm.

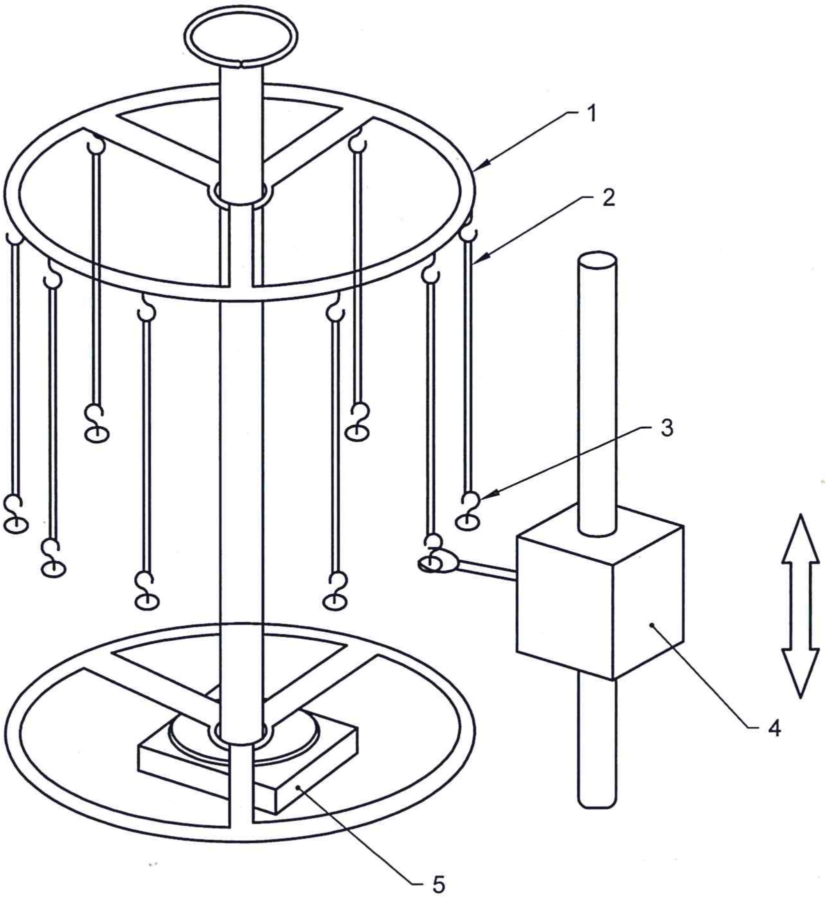
c) Fitted with a specimen holder, over 600 mm high, in which a number of skeins arranged and tested in succession. Each skein is applied with a 2.5 cN load, which remains throughout the whole testing procedure.

5.3 Boiling Water Container

a) The utilizable space shall have a height of at least 600 mm and suitable width and depth to accommodate the specimen holder of the shrinkage tester in an upright position, so as to make the specimens completely covered by boiling water during the thermal treatment.

b) The temperature shall be adjustable to 100°C. The temperature variation from the set value shall not exceed ± 3°C.

c) The specimen holder of the shrinkage tester shall be fixed in boiling water container.



KEY

1. SPECIMEN HOLDER
2. SPECIMEN
3. 2.5 cN LOAD
4. LOADING APPRATUS AND LENGTH MEASURING SYSTEM
5. FORCE MEASURING SYSTEM

FIG. 1 AUTOMATIC SHRINKAGE TESTER

5.4 Ventilated Oven

Which meets the following requirements:

a) The interior height shall be at least 600 mm, to accommodate the specimen holder in an upright position. The occupied space is not more than 80 percent of the volume.

b) A thermometer to measure and record the temperature in the vicinity of the specimens.

c) Forced ventilation so as to maintain the temperature to an accuracy of ± 3°C.

5.5 Reagent

a) Distilled water or grade 3 water in accordance with IS 1070.

b) Surfactant with wetting effect in concentration of 1 g/l.

6 SAMPLING AND PREPARATION OF TEST SPECIMEN

6.1 Sampling

Sampling shall be performed as follows:

a) bulk laboratory sample shall be taken on demand; and

b) number of lot sample and laboratory sample are listed in Table 1.

6.2 Preparation of the Test Specimen

6.2.1 Discard yarns on outer layer of the package in the laboratory samples. If test specimens are sampled from the same package, at least 5 m yarn shall be discarded between each specimen.

Table 1 Number of Lot Sample and Laboratory Sample

(*Clause* 6.1)

Sl No.	Number of Containers in the Consignment	Number of Containers in the First Selection	Number of Containers taken for Consignment Sample	Number of Packages Sampled from Each Container	Number of Packages Chosen for Laboratory Sample
(1)	(2)	(3)	(4)	(5)	(6)
i)	10 or less	all	all	*see* note below	20 approx
ii)	11 to 20	10	10	2	20
iii)	21 to 40	20	10	2	20
iv)	more than 40	40	20	1	20

NOTE — Take an equal number of packages from each container. The number of packages for laboratory sample shall be at least 20. If the consignment includes less than 20 packages, sample all of them. Packages that have been dampened, bruised, or opened during the transportation shall not be sampled.

6.2.2 Lead the yarn through the tension device and fix the end on the clip of the reel. Smoothly reel the skein using uniform tension lower than the specific tension (calculated as formula 2) and reel the specific turns (calculated as formula 1). Cut the yarn close to the clip and tie two yarn ends together, without stretch. Remove the skein from the reel carefully and avoid tangling.

$$n = \frac{T_t}{2 \times T} \quad \text{---- (1)}$$

Where,

n = number of turns, rounded to nearest whole number;

T_t = set linear density of the skein, in dtex (*see* Table 2); and

T = nominal linear density of the specimen, in dtex.

Table 2 Set Linear Density of the Skein

(*Clause* 6.2.2)

Sl No.	Nominal Linear Density of the Specimen	Set Linear Density of the Skein
(1)	(2)	(3)
i)	≤500 dtex	2 500 dtex
ii)	>500 dtex ~ 3 000 dtex	10 000 dtex

NOTE — A recommended skein for >500 dtex ~ 3000 dtex (for example BCF yarns) may be a single yarn loop hank/skein (made on 1 meter wrap reel) which is an alternate procedure of 10,000 dtex hanks for yarns range >500 dtex ~ 3000 dtex as per above table. The load for the length measurement in automatic shrinkage machine shall be set according to the total yarn loop count to reach specific loads of 0.2 cN/dtex (textured yarns) or 0.05 cN/dtex (flat yarns) as stipulated by this standard.

6.3 Numbers of Tests

6.3.1 For bulk laboratory sample, the minimum number of specimens shall be 2 from each package and the total number of tests shall not be less than 20 for one lot.

6.3.2 Batch laboratory sample shall contain at least 20 packages and each package is tested twice.

7 TEST PROCEDURES

7.1 Preconditioning and Conditioning

7.1.1 The standard atmosphere for preconditioning, conditioning, and testing shall be as specified in IS 6359.

7.1.2 Time for specimens to reach moisture equilibrium shall be more than 2 h before treatment, and more than 4 h after treatment.

7.2 Measuring the Initial Length of the Test Specimens

7.2.1 Hang the skeins sequentially on the specimen holder of automatic shrinkage tester (*see* **5.2**), while knots placed at the hook. Attach a tension load of 2.5 cN to the bottom of each skein so as to avoid entanglement and keep skein vertically downwards.

7.2.2 Place the holder into the automatic shrinkage tester and set the tension according to formula 2. After automatically applying and maintaining the tension for (10 ± 1) s, auto-measure the straightened length L_0 of a skein, to an accuracy of 0.1 mm.

$$F = P \times T_t \quad \text{---- (2)}$$

Where,

F = tension, in cN;

P = tension per unit linear density, in cN/dtex;
— non-textured yarns, (0.05 ± 0.005) cN/dtex,
— textured yarns, (0.20 ± 0.02) cN/dtex.

T_t = set linear density of the skein, in dtex (*see* Table 2).

7.2.3 Repeat auto-loading and auto-measuring procedures in sequence, until all skeins in the specimen holder have been tested.

7.3 Boiling and Drying Treatment

7.3.1 Fill the container with reagent specified in **5.5**. The quantity of reagent shall be sufficient to make the specimen holder completely immersed.

7.3.2 Place the specimen holder with the specimens and tensioning weights into the boiling water container preheated to the required temperature. Maintain it vertically, immerse it completely in water and keep it there for (30 ± 5) min.

7.3.3 After treatment, take the specimen holder out carefully and let the water drip away for 10 min. Then place the specimen holder into the oven (*see* **5.4**) at a temperature of (80 ± 3)°C for 10 min. If the specimens are not completely dry, extend the drying time accordingly. Afterwards, expose the specimens in standard atmosphere to reach moisture equilibrium. Alternatively, the specimens may be just exposed in standard atmosphere, without oven-drying, to reach moisture equilibrium.

NOTE — Since the boiling point of water depends on the air pressure, the shrinkage in boiling water would change subject to air pressure.

7.4 Measuring the Length of the Test Specimens after Treatment

Following similar procedure in **7.2**, place the specimen holder into the automatic shrinkage tester and measure the straightened length L_1 of each skein to an accuracy of 0.1 mm.

8 CALCULATION AND EXPRESSION OF THE RESULTS

8.1 Calculation

The shrinkage in boiling water is calculated according to Formula 3, and shall be accurate to the first decimal place.

$$BWS = \frac{L_0 - L_1}{L_0} \times 100 \qquad \text{---- (3)}$$

Where,

BWS = shrinkage in boiling water, in percentage;

L_0 = length before treatment, in mm; and

L_1 = length after treatment, in mm.

9 TEST REPORT

The test report shall include the following information:

a) A reference to this Indian Standard;

b) All details necessary for the identification of the sample tested (including method of preparation, if applicable);

c) Testing conditions (temperature, boiling point of water, treatment time, loading speed and tension);

d) Air pressure;

e) Test results (length of the test specimen before treatment, length of the test specimen after treatment and shrinkage in boiling water);

f) Any deviation, by agreement or otherwise, of the procedure specified; and

g) Any unusual phenomenon observed.

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Physical Methods of Test Sectional Committee, TXD 01

Organization	*Representative(s)*
Central Institute for Research on Cotton Technology, Mumbai	Dr P. G. Patil (***Chairman***)
Bidhata Industries Pvt Ltd, Mumbai	Shri R. K. Pacheriwala Shri Rohit Pacheriwala (*Alternate*)
Central Institute for Research on Cotton Technology, Mumbai	Dr Pradeep Mandhyan Dr T. Senthilkumar (*Alternate*)
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In Personal Capacity *(B-21, Parijat, Talepakhadi, Eskar Road, Borivali, Mumbai-400091)*	Dr R. P. Nachane
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Scientist 'D' (TXD), BIS

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Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices:		*Telephones*
Central	: Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	2323 7617 2323 3841
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